Using Electrodermal Activity to Recognize Ease of Engagement in Children during Social Interactions

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Motivation

Children's emotional self-regulation and co-regulation are key components in understanding engagement.

Can we characterize qualitative aspects of children's social engagement with wearable biosensors?

Experimental Setting

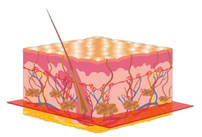
External coder
"Amount of effort required to get child's attention"

Ratings per activity:
- 0 – *little effort*
- 1 – *some effort*
- 2 – *extensive effort*

23 sessions excluded (artifacts)
51 sessions used for analysis
- *Easier* to engage (N: 29)
- *Harder* to engage (N: 22)

Electrodermal Activity (EDA)

Affectiva Q™ sensor



Good Indicator
- Arousal
- Cognitive Load

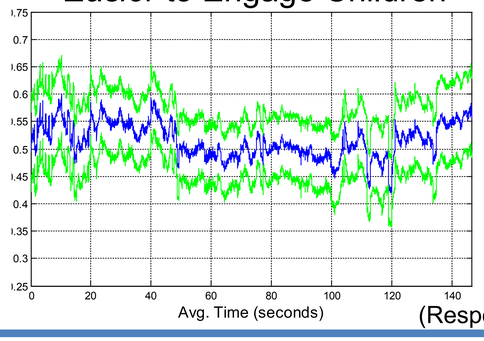
Limitations
- Specificity
- Artifacts

- Wireless
- Comfortable

- 32 Hz
- 4 sensors

Characterization of EDA Responses

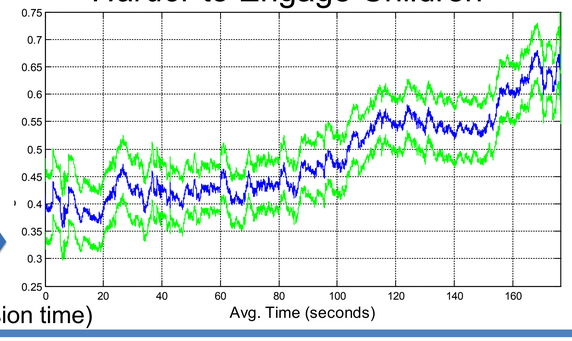
Easier to Engage Children



EDA levels stable
Shorter sessions
(N: 29)

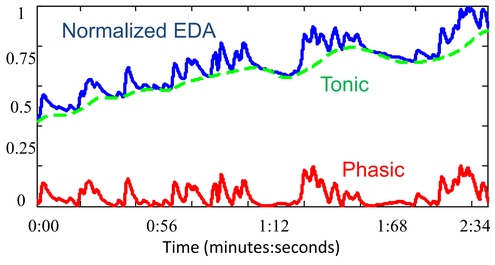
EDA levels increase
Longer sessions
(N: 22)

Harder to Engage Children

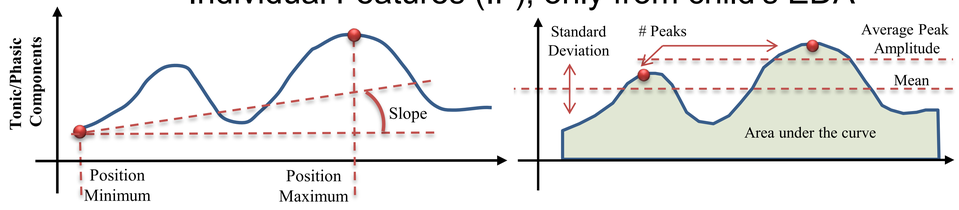


(Responses were resampled to last the average session time)

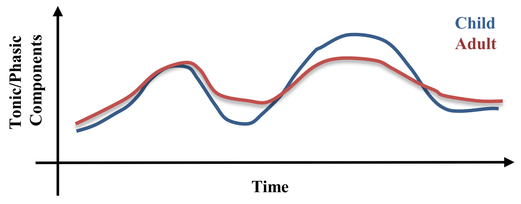
Processing
1. Normalize EDA values
2. Reduce noise
3. Extract tonic and phasic EDA
   (Benedek and Kaembach, 2010)



Individual Features (IF); only from child's EDA



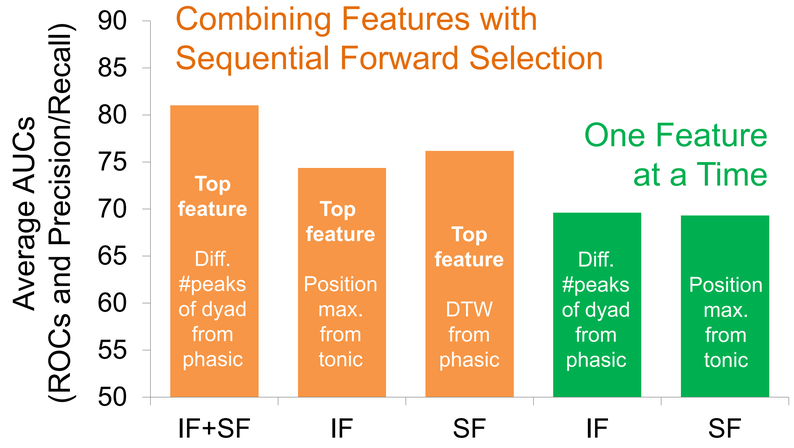
Synchrony Features (SF); from the dyad's EDA



Correlation between responses:
- Pearson correlation
- Canonical Correlation
- Dynamic Time Warping

Differences between features:
- Means
- # Peaks
- Avg. peak amplitude

Easier vs Harder to Engage with SVMs



SF and IF similar performance
IF better from tonic
SF better from phasic
Tonic and Phasic decomposition improved >6%

Feature selection improved >11%
SF slightly better than IF (>2%)
Tonic and phasic equally represented
SF and IF are complementary

Hernandez J., Riobo I., Rozga A., Abowd G. D., Picard R. W., (2014), Using Electrodermal Activity to Recognize Ease of Engagement in Children during Social Interactions, In Proc. of Inter. Conf. on Ubiquitous Computing, 307-17